METHOD AND SYSTEM FOR ADAPTIVE TRANSMISSION OF SMOOTHED DATA OVER WIRELESS CHANNELS

RELATED APPLICATION

This application is a continuation of application Serial No. 09/470,481, filed December 7, 1999.

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to data transmission over wireless networks. More specifically, the invention relates to reducing the impact of wireless channel instability on data streams by selecting data packets for transmission based on priority of the data packets.

2. Description of Related Art

When a video data packet is delivered over a network, it typically shares the link with data packets and other audio/video data streams. As a result, if the available bandwidth is lower than that necessary to transmit the video data, long packet delay or even packet loss results. Various approaches have been proposed for adaptively transmitting and playing-out the video data based on network conditions to handle this type of situation and to reduce the impact of packet loss on video data quality.

In one conventional method, the play-out time at the player's end may be adjusted within a small range based on information about delay and the amount of data in a client buffer to prevent potential play-out discontinuity. See R. Ramjee, J. Kurose, D. Towsley and H. Schulzrinne, "Adaptive Playout Mechanisms for Packetized Audio Applications in Wide-area Networks," Proceedings IEEE INFOCOM '94, ~~Toronoto~~ Toronto, Canada, 12-16 Jun. 1994, pp. 680-88 and M. C. Yuang, P. L. Tien and S. T. Liang, "Intelligent video smoother for multimedia communications," IEEE Journal on Selected Areas in Communications, February 1997, vol. 15, pp. 136-46.

Another conventional method implements an adaptive forward error control algorithm at a network node to reduce the packet loss rate. See J. C. Bolot and T. Turletti, "A Rate Control Mechanism for Packet Video in the Internet," Proceedings IEEE INFOCOM '94, Toronto, Canada, 12-16 Jun. 1994, pp. 1216-23 and J. C. Bolot and T. Turletti, "Adaptive Error Control For Packet video in the Internet," Proceedings of International Conference on Image Processing, Lausanne, Switzerland, September 1996, pp. 25-28.

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were of the highest priority, and for the rest of 1000 bits, half were of priority 1 and the other half were priority 2. The simulation assumed a play-out period of 6 mini-slots. One frame was sent from the server, hence one was received at the base-station, every 6 mini-slots. The size of the wireless packet was 500 bits and that of a regular packet was equal to the frame size. The initial buffer occupancy at the client was 6000 which was exactly the total of the first three frames. A simulation was performed to investigate how *QI* changes with load by fixing the value of p_{GG} and changing p_{BB} for different thresholds , h being set at 0.7, 0.9, and 0.99, respectfully. The data shows that most of the curves drop suddenly once or twice as the load increases from 0.6 to 2. ~~To provide more specific results, Table 1 lists the total number of packets transmitted in each layer when~~ $\cancel{p_{GG} = 0.71}$ ~~for the three thresholds~~ $\cancel{h = 0.7, h = 0.9}$ ~~and~~ $\cancel{h = 0.99}$~~.~~ This data indicates that the reason why the *QI* curves drop suddenly at some points, when p_{BB} exceeds certain value, is that almost an entire layer is lost.

The exact value of this critical point for p_{BB} depends on p_{GG} and threshold h. For instance, when threshold h equals 0.7, starting from $p_{BB} = 0.71$, almost the entire layer 2 is dropped. When $h = 0.9$, most of the layer 2 packets are dropped starting from $p_{BB} = 0.41$; and from $p_{BB} = 0.71$, all layer 1 packets are also dropped. While for $h = 0.99$, the two drops take place even earlier at $p_{BB} = 0.11$ and $p_{BB} = 0.31$ respectively. Right after each drop, the number of packets transmitted in each layer changes very little as p_{BB} increases. However, the load increases with p_{BB}, which means the best quality one can achieve from the system actually worsens rather than improves as p_{BB} increase. Therefore, the relative performance of the system becomes better, the *QI* increases and the curve goes up with the load.

An explanation for these sudden drops is now provided. In the exemplary embodiments, as explained above, $P_{X_{l},R}$ is calculated to determine which packet to deliver at the end of each mini-slot. For a long CBR video data stream, ~~such as that used in the simulation associated with Figs. 10(a)-10(e),~~ calculation of: